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Barthelmie, Rebecca Jane; Pat, Moriarty; Frandsen, Sten Tronæs

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TRACK: TECHNICAL TOPIC: Wakes

UNIVERSAL BENCHMARKS FOR WIND TURBINE WAKE AND WIND FARM MODELS

Rebecca Barthelmie (Indiana University/Risø DTU, Atmospheric Science/Wind Energy, United States of America)
Moriarty Pat, (1) Frandsen Sten, Denmark (2)
(1) NREL (2) Risø DTU

We propose a benchmarking framework for wind turbine wakes and wind farm modeling. This represents an extension of the work within IEA Annex 23 to improve wind farm modeling techniques but includes onshore and offshore wind farms. The purpose is to gain insight into the benefits and drawbacks of a set of modeling assumptions for a wide range of applications. Much of this new task will involve benchmarking models of wind farms against other models and actual wind farm data. As such, participation by industrial partners willing to share wind farm data will be of utmost importance.

We are proposing to launch a benchmarking exercise to assist modelers to evaluate model performance with regard to wind turbine wakes and wind farm modeling. The purpose is to ensure that wind farm modeling continues to improve and to provide evaluation criteria. The benchmarks will involve model intercomparisons and also comparisons to field data. Some benchmarks may exist already, such as various datasets from the Horns Rev wind farm, but some will need to be developed in the coming years. These benchmarks can include, but are not limited to the following:

• Model to Model or Theoretical

o Single Wake – how do models compare for a single wind turbine wake?

o Multiple Wakes – how do models compare for the case of more than one upstream wake?

o Infinite Wind Farm – what is the production from an infinitely large wind farm? Is there and asymptotic relationship between size and production losses?

o Stability Classes – what is the impact of atmospheric stability on wind farm production?

o Complex Terrain – what is the effect of complex terrain on wind farm production?

• Model to Measurements

o Wind Farm Size – what is the impact of wind farm size on overall production?

o Stability Classes – what is the impact of atmospheric stability on wind farm production?

o Complex Terrain – what is the effect of complex terrain on wind farm production?

o Advanced Control Schemes (e.g. ECN's Heat and Flux) – what control strategies can optimize wind plant performance over a range of operating conditions?

Best Practices

As a final result of the framework, participating members will strive to produce a document of best practices for the industry. The practices will cover the wide range of tools currently used by the industry and attempts to quantify the uncertainty bounds for each of the different types of models.